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ABSTRACT

Educators are asked to provide technology education to all, but special consideration must be given to those in both developing and developed nations who have no access to current technology and thus are disenfranchised. In order to redress the issue of disenfranchisement, one must try to correct the social imbalances that have created it. Curriculum changes alone cannot correct or provide access to high-quality education. Although money alone cannot solve the problem, it can contribute to a solution, as will time. Countries and individuals that are struggling will slowly become more stable and have resources available to promote a policy of technological access through education. All policy makers must commit to collaborative and interdisciplinary education for all students over the long term. Only then will all people be able to compete in the complex society of the 21st century. (Contains 1 figure and 10 references) (KC)

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Technology Education:

Addressing the Needs and Concerns of the Technologically Disenfranchised and Special Needs Populations

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INTRODUCTION

Educators in technical/vocational disciplines are being asked to make sweeping changes to curricula and programs that reflect the technological changes that are taking place in society today - changes brought about by technology. Changes in the way we communicate, the way we manufacture, the way we do business in the information age. These changes are truly global in nature and influence almost every facet of our lives. Indeed, technology affects the way we purchase products, select the food and medicine we provide to our families, and most notably, has changed how we communicate with one another. Perhaps nothing illustrates the dramatic technological leaps society has faced in this generation more than the computer revolution and the advent of the Internet. The continuing demand for more powerful computers with larger storage capacity has been fed by our desire to gather more and more information. This thirst to know more, and obtain it faster, has created technological demands in the already hyper-speed pace world of work and leisure. It influences our businesses, homes, and classrooms, and is more often than not more bewildering to some than it is reassuring.

As professionals in what we might be pleased to call the "technologically progressive nations," we are able to both manage and provide bits and bytes of information in quantities that just a few years ago were considered a dream of things to come. Indeed, there are many among us who doubtless consider their days a waste of waking hours if they are not able to receive a daily dose of e-mail, or surf-the-net. We have become so concerned about the information that we might receive that even while we sleep we demand our information servants to stand on vigilant duty guarding precious data retrieved by e-mail, fax and answering machines until we can once more join the active world.

This vast amount of accessible information, and the interaction it allows us with our fellow man, in only moments of time, are mere key-strokes away from us in our offices, our homes, and even as we travel. Who knows how much more data is simply waiting to be harvested? The field of information available covers such a breadth of knowledge, in such diverse levels of interest, that at times the deluge of facts presented for our consumption may seem more of "a solution in search of a problem", rather than the means of bringing any inquiry to a successful conclusion. However, in the midst of this technological whirlwind we have lost sight of what has become one of our most serious concerns. What can be done to alleviate the vast numbers of the technologically disenfranchised that are among us? Those that have no access to technology that would allow them to improve their position in society. I'm referring to

those that can not afford an education or are unable to get an education due to socio-economic conditions. I'm also referring to those in our prisons, for numerous reasons, that upon release have no skills, no knowledge of current technology and therefore have no hope of improving themselves. These are special needs populations that require us to rethink how we provide access to education at all levels.

THE DISENFRANCHISED

Many may believe that only those citizens in what many call third world nations face the deprivation of technological access that we have at our fingertips. Some may believe that only nations, which have enormous populations or crumbling economies, are those without access to technology. The fact is that the technologically disenfranchised exist in all nations including the more prosperous industrialized nations. They are those individuals who have little to no access to the type of education and training, due to economics or social condition, required in order to function at any meaningful employment in the future, employment that increasingly requires employees that have technical skills and computer literacy. They are all about us and yet we often fail to recognize them because of the isolation that seems to separate the technology "haves" from the "have-nots." It is easy to recognize those that are in prison as disenfranchised, yet technological communities have a social system that parallels the civic townships where we reside. There are those within the system that are sophisticated technocrats, those who are moderately computer literate, and those who wander helplessly through a world of bits and bytes knowing not which way to turn.

Who are these disenfranchised populations? They are those members of society, in all cultures, that have never profited from an education. They are those that had circumstances in their lives that either kept them from school, convinced them that they were not smart enough to learn or they just lacked the encouragement to try. Without encouragement and support from some source, many see no reason to try. Many end up unemployed, on public support, or in some cases wind up in prison and find that this is their last hope for an education. They are among us and without programs to meet their needs will remain disenfranchised and lost to society.

The question of technological inequity is not an easy one to address or solve. If societies lack the technology to retrieve and process information, it is not just a matter of buying computers to solve the problem. While such a remedy seems obvious to most it does not address

the root of the problem. Problems created by a lack of technology are most often not solved simply by throwing money at them - by supplying a "technological fix." Most problems associated with a society that may suffer from diminished, outdated, or simply no technology, are not due to a lack of systems, or equipment, or a desire to have these things. The fact is technological problems are rarely caused by a lack of software or disks or even telephone lines which feed modems. Most technological problems are rooted in social and cultural fields of interest. As Volti (1992) explained, "The list of technologies that have been or could be applied to the alleviation of social problems is an extensive one, and examples could be supplied almost indefinitely. What they have in common is that they are 'technological fixes', for they seek to use the power of technology in order to solve problems that are non-technical in nature".[1]

Regardless of the reasons a society may or may not accept technology, there is one fact that we cannot dispute, the world changes within a society whether it accepts or rejects technology. Perhaps the biggest change concerns the "sense" which the community has about itself. Before exploring this idea, some given facts need to be considered. It is not difficult to look around various communities in any nation and quickly spot their distinct cultures by the icons associated with them. or example, cowboy hats are worn in Texas by men and women, they can be seen everywhere. They are not so evident in London England. Most people who speak English as a second language retain aspects of the accent or intonation of their native language that can allow others to identify their country of origin. Immigrants to all nations do not suddenly lose their native customs upon arrival in their adopted homeland, but usually continue to celebrate holidays and family occasions as they learned to do as a child. All of these contextual clues suggest something to us about the feeling a person has about the community in which they live. But, whenever a new technology arrives within a community it cannot but influence the way in which the established customs of that community are practiced from that point on. Referring to technology's impact on community identification, oster (1997), expressed the opinion that:

> Community, then, is built by a sufficient flow of 'we-relevant' information. The 'we' or the collective identity that results is structured around others who are seen as similar to the 'me'. In this sense, community, like any form of communication, is not fully realized without the conception of self. Essentially, this entails that "...what goes to make up the organized self is the organization of the attitudes which are common to the group. A person is a personality because he belongs to a community (Mead, 1993, p.159).[2]"

Perhaps then the major reason that societies, or people within a given society become disenfranchised, is due to the fact that they shun technology because it changes them. Marshall McLuhan (1962), promoted the notion that information (specifically printed words) would cause the breakdown of national boundaries, the blurring of cultural identity, the "detribalization" of society.[3] Information would break down borders and unite people into one central community. As has been expressed, information changes societies and how they view themselves. Perhaps that is the basis of the question before us - the loss of identity. Do some societies or individuals view self-disenfranchisement as preferable to the loss of their identity?

Methods must be addressed on establishing strategies for meeting the needs of such populations. Educators must provide students everywhere with the skills that will allow them to become contributing members of society, able to meet the demands of the technological future. Purchasing computer technology is not the sole answer; people must know how to use them. They must possess the ability to read, write, and solve problems. Educators, along with business and industry, must provide resources and activities that will facilitate this learning process.

DEFINING TECHNOLOGY

In the midst of all this change there are still the nagging questions being asked by lay people as well as professionals: "What is Technology?" "What is Technology Education?" There are many definitions for technology and technology education being offered depending on who you talk to. The terms are unavoidable and for the most part widely misunderstood. Technology has been defined as hardware; it has been narrowly defined as computers; it is defined by some as organization; it is seen as a process by which we take action to do things and to still others it is what we use to produce products and provide services. Even more difficult is the problem of defining and coming to consensus on a definition for "Technology Education." If professionals are having difficulty coming to grips with definitions, where does that leave the rest of the global community? "Technology" is the key to the gateway of the twenty-first century, therefore the term must be clearly defined, and the process, if as educators we are to provide the pathway for our students to follow. To that end, the following definitions are provided for each in the simplest of terms as they have come to be understood in general use.

TECHNOLOGY- It is a general term used to describe a body of knowledge and processes we as human beings use to fashion tools and machines to extend the human potential and control of the natural and human-made material environment by which we meet our needs and wants and improve our surroundings. (Simply put, "It is people using tools to improve their surroundings.")

TECHNOLOGY EDUCATION - The study of technology in an educational program that helps students develop an understanding and ability to use technology in designing and producing products and systems, and in taking responsibility for and assessing the appropriateness of technological actions.[4] Wright, et. al. (1993)

Not only do we need to fully understand these definitions, our students, our colleagues, our global community, needs to have a clear understanding and be in agreement as to the real meaning of these terms and definitions. It is evident from material reviewed that most everyone agrees, with minor exceptions, with the above definitions. We must also understand what Technology is not. Technology, often times called applied science, is not the study of science. Technology is the study of the human made world; science is the study of the natural world.

We are being asked to change how we teach academic and technical subject content areas by business and industry around the world that employ our students upon completion of a course of study. The reason, it is not enough to know the outcome of 2 + 2. The student must know what to do with "4".

Students, this means all of our students, all nations, must be able to apply what they have learned if they are going to be able to compete in a complex technological world. Some of the answers lie in integration. By integrating academic and technological subject content areas, keeping the three elements of good teaching in mind: ***Content***--the material that is taught; ***Context***--the physical and psychological environment of the classroom; ***Mode***--how the information is treated or presented; we can meet the needs of the student. Many educators seem to be inclined to think in terms of content only when tasked with a curriculum change. We as practitioners must think in terms of all three if we are to be successful at integrating subject areas. Teachers serve as role models, not just to students but to other teachers as well. What better way to show how integration works than for students and administrators see the teachers of varied subject areas collaborating for a common goal, teaching the whole student.

METHODOLOGIES, STRATEGIES & CURRICULUM

"There are many ways of teaching and no one way is superior."[5] So concluded Cooley and Leinhardt (1980), in their large-scale study to identify effective methods in teaching. However, the method must be consistent with the goals of the curriculum and the outcomes sought. The theories of John Dewey are among the foundations for the practice of education today. One of his most prominent ideas was the relationship of thinking skills as they relate to problem solving; the forerunner of today's "critical thinking skills." Dewey's method is much like the scientific method. His method consisted of five steps: (1) Define the problem; (2) Observe the conditions; (3) ormulate the hypothesis; (4) Evaluate possible consequences; and (5) Active testing to see which idea best solves the problem.[6] Tanner and Tanner (1987).

The point is, the teaching methodology must be available to all students and, must get the student excited about the process of learning. It must meet the stated goals and expected outcomes of the curriculum and it must be of obvious value. No subject can be taught in a vacuum for its sake alone with abstract values that have no obvious concrete meaning or connection to anything else. That is how these writers see many academic teachers still teaching their subjects in some schools today. The direct instruction method, used by many academic subject teachers, presents the material in an abstract manner without real concrete application. Even science labs can leave the student wondering; what is the application? It is not always as successful as cooperative learning. If you look in any study hall or school library, you will find groups of students working together to complete assignments. This usually occurs because one or more students understand the material and others need help. Technology Education uses more individualized and cooperative learning with concrete or applied outcomes and less direct lecture. When academic and technology teachers work together as facilitators and intentionally break students into those same small study groups in the classroom, critical thinking and problem solving skills thrive. Each student and idea generates numerous other responses. Those students that need help do better and those students that do well in class usually score higher. The strategy that encourages collaboration between academic and technological based curriculum structures is what will best serve our students in the next century.

STRATEGY OR IMPLEMENTATION

How do we implement strategy and curriculum? We must ask the questions, "What do academic students really know? What do technology students know how to do? What do we need them all to be capable of?" Once we focus on this, the solution to the real problem of collaborative instruction and Applied Technologies will become clear. We must take steps to plan the process. We must not allow attitudes and the turf war issues so common between academic and vocational/technical areas to become the focus. We must focus on the goal, teaching the whole student so they are ready to enter society as a functional contributing member of a technological world community, able to solve complex problems. The result of this collaboration will be higher student achievement, improved student motivation, increased course enrollment, increased student retention, better cross cultural communication and, better utilization of limited available resources.

But, what does the curriculum look like? How will it fit in current school structures? What is the cost? How will it meet the needs of the disenfranchised? These questions need to be considered by school administration, teachers, the community at large, and the very students we are trying to reach. These are the real stakeholders in this process. What type of education your students get will depend on your answers to these questions. Do not let the status quo be the answer. If you do not progress today, you will fall behind tomorrow.

APPLICATION OF TECHNOLOGY

As we leave the 20th century behind and head into the 21st, we will have experienced the greatest revolution since the industrial revolution started in the 18th century. We have learned to communicate by means never even thought of or imagined before this century. The integration of technologies and systems have allowed for the creation of inventions that have carried us to the moon and allowed the blind to see. All because of the vision and the knowledge of people using technology to control the "human-made world" and improve their surroundings. People use technologies today that they do not even understand but trust in the system that created them. Our students today are going to be tomorrow's technologists. Batteries and solar cells may power the car they will drive controlled by a computer guidance system. No carburetor, no fuel injection, no engine to tune up; even today's cars are computer controlled and need specially trained technicians to operate the analyzers to trouble-shoot and adjust them. Without an understanding of systems, computers and the ability to relate to multiple systems the technician

of tomorrow will be lost. They will require interdisciplinary skills, the ability to analyze, interpret, and apply information to vastly different systems. The school system of the future must address the need for these interdisciplinary skills by changing the curriculum structure today.

SUBJECT CORRELATION - KEY TO INTERDISCIPLINARY CURRICULUM

The correlation of subject content, the real backbone of interdisciplinary curriculum, has found solid roots in the middle school movement. That is, they have been able to build appropriate bridges to other disciplines. Without those bridges, a true interdisciplinary/integrated curriculum structure is not possible and the process is doomed to failure. The collaboration between teachers of all disciplines is absolutely necessary to meet the goals of integration. Connecting the curriculum structure as we approach the 21st century is no longer an option. It must happen if we are to provide the type of education our students need to enter the colleges, universities, and the job markets of the future. Whether they work at McDonald's, or Boeing, they will need language arts, math, science, communication, and organizational skills if they are to succeed.

Interdisciplinary or integrated curriculum is viewed, in general by most educators in literature reviewed for this paper, as the organization and the transfer of knowledge on a unified continuum from general to specific. There are many valid reasons to integrate curriculum. Listed here then are just a few reasons why it should be implemented: Maurer (1994) [7]

- Teaches students how to transfer knowledge
- Involves the community as a learning environment
- Teaches students how to analyze, explain and apply knowledge
- It is competency based
- Students are taught how to make decisions
- Students learn how to work cooperatively with others
- Improved student retention of knowledge
- Students see the value of the educational experience

The whole purpose is to develop a learning environment that allows students to make connections with knowledge. It develops a student that can see a connection between subject content areas and apply that knowledge and skill to solving real life problems. In an integrated curriculum the concepts taught in math, science, language arts and technology become related and the students start using higher-ordered thinking skills such as interpreting, explaining, and

making analogies. The following diagram (figure 1) shows how related curriculum areas could be developed into a learning activity.

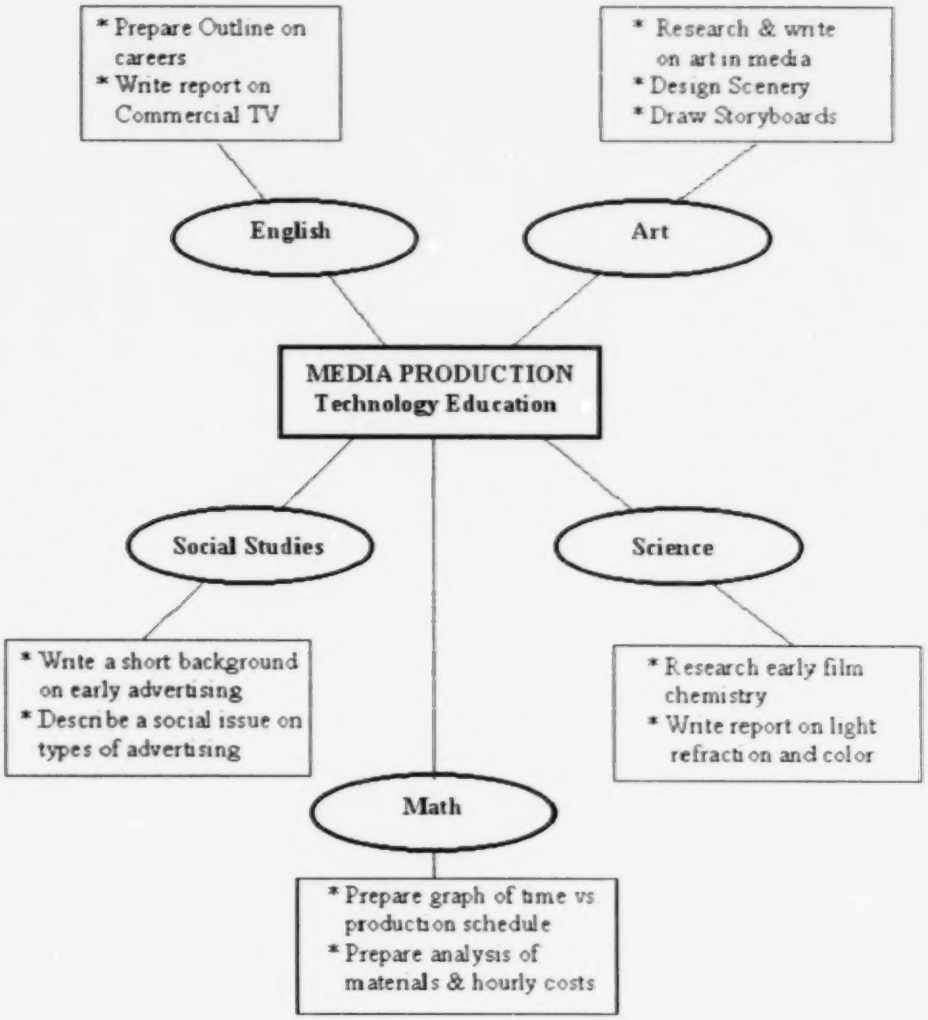
* Prepare Outline on careers
* Write report on Commercial TV
* Research & write on art in media
* Design Scenery
* Draw Storyboards
English
Art
MEDIA PRODUCTION
Technology Education
Social Studies
Science
* Write a short background on early advertising
* Describe a social issue on types of advertising
* Research early film chemistry
* Write report on light refraction and color
Math
* Prepare graph of time vs production schedule
* Prepare analysis of materials & hourly costs

Figure 1 - Correlated Diagram

CONCLUSION

If we wish to redress the issue of disenfranchisement, we must labor to correct the social imbalances that have created it. Curriculum changes alone can not correct or provide access to quality education. Diettrich (1993) suggested that the solution to this inequity may be found in a complex interplay of several factors. As stated:

> "One possible interplay is the exchange of scientific, technological, economic and other factual data, information and arguments with a view to the elimination of misunderstandings and the possible rationalization of conflicts...This is the very root of the idea of public information: the more people are informed the more successful will be their decisions."[8]

Paralleling these views Cantley (1987) wrote, "If there is...control without understanding, there is danger not only to science and technology, but ultimately to the society itself."[9]

At the beginning of this discussion we began by suggesting that money alone cannot solve the problems of being disenfranchised, nevertheless, neither can we exclude its need. If we can judge by past experience then there is every indication that time will assist in the resolution of this problem. Countries with struggling economies will slowly become more stable and have resources available to promote a policy of technological access through education. Then their lives will change and perhaps they will find themselves again on the bottom rung of the ladder, albeit a technological one.

The road will be a long one for many. Indeed, some will never arrive at the destination they desire. However, some will. In an effort to ensure that as many as may wish to join the society of the informed, and in effect assist those who desire citizenship in the global community, we must ensure that the path is clearly laid out for them to follow. In fact, the road to technological equity is not unmarked, but is well-worn and easy to travel. All we must do is assist those trying to find it and once there point them in the direction that leads forward. As Tehranian (1990) wrote:

> The hardware and software technological requirements...are thus already for us. The challenge is to create the cognitive technologies by generating the appropriate values and norms, political consciousness and will, and institutional arrangements...To insure citizen participation, however, at least two conditions must be met. The services must be made universally available and the price must be affordable...But the seeds of a powerful idea have already been planted in the minds of the citizens...[10]

There are no quick fixes; we must commit to quality collaborative and interdisciplinary education for all students over the long term. Only then will our students, young and old, rich and poor, in all nations of the earth, be able to compete in the complex society that awaits all of us in the 21st Century.

Endnotes

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Biographical Information

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